September-October 1952

METAL TREATING

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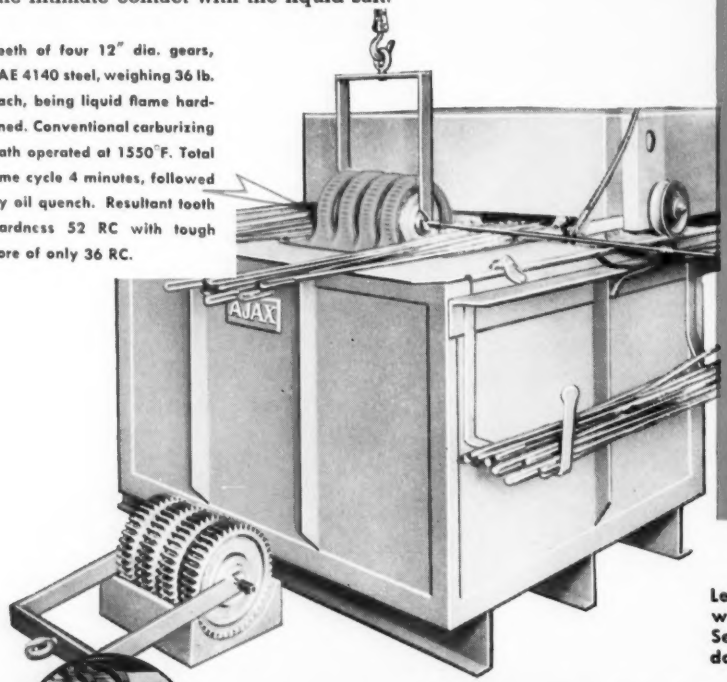

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Editorial...

EDITOR'S NOTE: *Beginning with this issue, we will, from time to time, run guest editorials prepared by executives of MTI member companies. Both the editor and the authors will welcome reader comments at any time.*

"MESSING IN POLITICS"

We, who enjoy personal privileges vastly beyond those of any other Nation's people, are inclined to forget that we inherited these blessings from men who had the guts to fight for them. Their vision, courage and determination created a form of government and a mode of life where a man could be a man, not a plastic dummy to be pushed around a set of squares by an all-wise paternalistic planner.

A guy was free to make his own mistakes in his own way, win, lose or draw—and could profit by his experience, if nothing else.

When the poet wrote "O'er the land of the free and the home of the brave", he expressed in those immortal lines the inseparable connection between liberty and courage. You don't have one without the other. No people have retained their freedom who did not care (or dare) to defend it.

Today, we Americans are doubly threatened with the loss of that blood-earned freedom which we have come to take for granted. Outside, a powerful enemy has openly sworn to do us in. For a long time we just didn't believe this, but now that the idea has begun to percolate, we reluctantly stir our stumps to moderately defend ourselves. Hope we make it.

Meanwhile, on the old home ground, we have been busily scheming up another play to bust ourselves. This is more dangerous than the outside threat, because it is self induced, self deluding, and self destroying. Some slick soapsters have resurrected and polished up an ancient gold-brick. This nutty nugget takes various shapes and forms such as—

1. We can all be rich on borrowed money.
2. Do less and you will get more.
3. The smaller the nickel the bigger the smoke.
4. Believe in Santa Claus and every day is Christmas.
5. Let the Great White Father run everything and you will be a very happy boy.

Of course, you know that this gilded gadget, in one variation or another, has been sold to people throughout history, ancient and modern, always ending in the same dismal flop.

A man cannot turn the responsibilities of living over to another without becoming that person's servant.

(Continued on page 23)

METAL TREATING

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National Trade Association of Commercial Heat Treaters

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HORACE C. KNERR, *Chmn., Pub. Comm.*, Metlab Co., Phila., Pa.
C. E. HERINGTON, *Editor* R. N. CALLAHAN, *Business Manager*
B. A. FLANAGAN, *Advtg. & Prod. Mgr.*,
271 North Ave., New Rochelle, N. Y.

SALES REPRESENTATIVES

LARRY CROSBY, 516 Fifth Ave., New York 36, N. Y.—MU 2-3383
WM. E. JACOBS, 2553 Pembroke Rd., Birmingham, Michigan
FREDERICK W. COLE, 80 Walnut St., Winchester, Mass.

Versatile Pit Furnace

Carburizes, Hardens and Draws—'Round-the-Clock

By A. H. Koch
Surface Combustion Corporation, Toledo, Ohio.

Small, or job lot, heat treat production with its inherent problems of production costs and scheduling are being very effectively met at Leach Manufacturing Co., Oshkosh, Wisconsin, by a new pit type controlled atmosphere furnace. This ATMOTROL vertical muffle furnace, produced by Surface Combustion Corporation, Toledo, Ohio, (see Figure 1), operates around the clock, treating many different types of parts while employing a variety of processes over a wide temperature range. Many of the parts heat treated in this furnace are for utility truck bodies, logging tools and special agricultural equipment.

Continuous operation of this furnace, with a whirling flow quench tank, has maintained production rates averaging about one ton of steel treated per day.

Only the top portions of the furnace and the quench tank extend above floor level. The lower portion of the furnace, with combustion system, recirculating fan and motor drive in addition to quench tank pumps, coolers and recirculating system are conveniently located in the basement where they are easy to get at for routine checks and servicing. This basement installation is a good example of the compact arrangements possible with this pit type furnace.

On the heat treat floor an overhead monorail hoist system is utilized for all charging, discharging and quenching operations. Quench tank and cooling pit are so situated, in relation to the furnace pit opening, that practically straight-line movement from furnace to quench is accomplished. (See Figure 3.) The 'Surface' MRX prepared atmosphere generator and a central control panel for furnace and quench operation are conveniently located near the furnace. The entire facility is very compact, permitting maximum handling efficiency which can prove extremely important in round-the-clock operation on a job-lot basis.

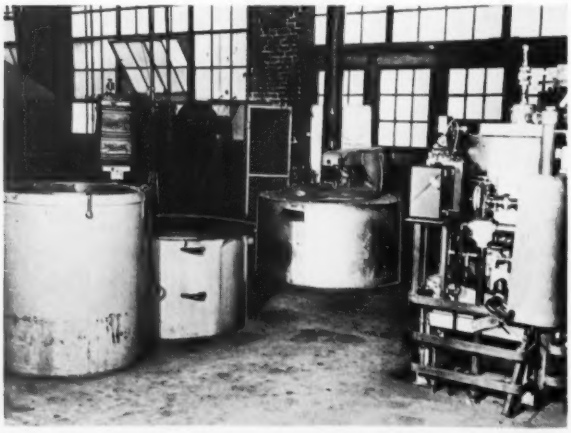


Fig. 1—Overall view showing quench tank and cooling pit to left, pit furnace in center background, and atmosphere generator to right in foreground.

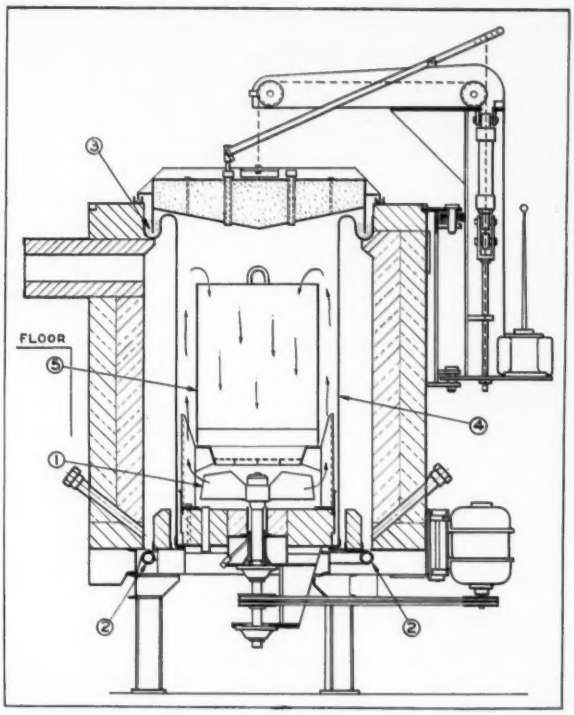


Fig. 2—Cross-section drawing of ATMOTROL vertical pit type muffle furnace. 1—Recirculating fan; 2—Burners; 3—Sand seal; 4—Muffle; 5—Basket; 6—Atmosphere inlet.

Carburize, Harden and Draw (400-1800°F)

By heat treating (hardening and drawing) during the day and carburizing only during the night shifts, maximum finish heat treated material is turned out during the peak shop production hours. The time-consuming carburizing treatments are thus accomplished during relatively inactive time. All of these treatments are carried out with remarkably consistent results over a temperature range from 400-1800°F.

This wide temperature range is maintained by two-stage multiple injection burner equipment operating on air at atmospheric pressure and gas at line pressure. These burners fire upward along the outer surface of the furnace muffle. (See Figure 2.)

Within the muffle, an alloy propeller type fan, rapidly circulates the atmosphere gases forcing them

through the densest charges. Temperature of these furnace atmosphere gases is automatically controlled and the flue damper, which is linked to the gas valve, is automatically adjusted during periods of reduced heat input. This arrangement provides maximum operating efficiency throughout the entire operating range.

Most of the rollers, plungers, bushings, pins and a number of other parts used in the truck bodies, barn cleaners and silo unloaders produced by Leach, are *carburized* in the ATMOTROL pit furnace. They are of mild steel, predominately SAE1020, carburized to an effective depth of 1/16 inches and .90 surface carbon by heating to 1700°F for 9 hours and 1550°F for 1 hour followed by quenching direct in oil. A furnace atmosphere consisting of RX atmosphere gas enriched with natural gas is used.

Logging tool parts, plus some links and rollers, are *clean hardened* in straight RX base gas without the enriching addition. The SAE1045 steels are heated to 1525°F, held for 15 minutes and *direct* quenched in oil. The SAE1335 steels are heated 1550°F and also followed by a quench in oil.

Drawing operations are carried out within a range from 400-1000°F, depending on type of part, steel analysis and mechanical properties required. All carburized and clean hardened parts are drawn within this range. A controlled furnace atmosphere is not maintained for these treatments.

Capacity 530 Lbs. Per Hour Gross

Furnace capacity is rated about 530 lbs. per hour gross at 1700°F. Charges usually average between 700-800 lbs. of steel.

The charge basket, of heat resistant alloy and grid bottom, is 24 inches in diameter and 36 inches deep. The muffle in which this basket is placed has an effective 33 inch diameter and 36 inch depth.

Lift cover, which rests in sand seal, is actuated by a hand operated hydraulic pump. Quench tank controls are also accessible on the same panels. (See Figure 3.)

Fig. 3—Operator charging pit furnace with overhead hoist conveyor. Straight-line movement is accomplished from furnace to quench tank.

All prepared atmosphere gas is provided by the MRX generator, of 250 cfh capacity, located about 20 feet from the pit furnace. The carrier gas is piped down to the basement and introduced to the muffle through the bottom of the furnace.

The RX gas atmosphere is produced by this generator by the endothermic reaction of a constantly proportioned air-gas mixture passed through an externally heated tube containing a special catalyst. The approximate analysis of this carrier gas is.

RX Gas

Dew Point (+ 10 to + 30°F) Adjustable

Constituent	Amount
CO_2	0.0%
CO	20.7
H_2	38.7
H_2O	0.0
CH_4	0.8
N_2	39.8

To insure constant production of a uniform analysis carrier gas, the temperature of the catalyst tube is automatically controlled. This is accomplished by a unique temperature control micro switch circuit which is actuated by linear expansion of the catalyst tube.

For a typical clean hardening operation, 180 cfh of straight carrier gas is utilized at a dew point of + 30°F. For gas carburizing, at 1750°F, 15 cfh of natural gas are added to 180 cfh of carrier gas at +20°F dew point. This addition is accomplished at the generator through a proportioning mixture. Carbon potential is closely controlled by taking dew point checks four times each 24 hour period with a dew point indicator. Dew point of gas is controlled as desired by a screw adjustment which regulates an orifice plate in the generator's air-gas mixer and varies the air-gas ratio.

Efficient utilization of a single pit type controlled atmosphere muffle furnace, with gas generator, has made it possible for this manufacturer to economically exploit the many flexible advantages of controlled atmosphere processing without maintaining the mass production rates usually required by this type of equipment. By carrying out three separate heat treat processes on a round-the-clock basis, floor space and equipment investments are kept to minimum and highly flexible production achieved at a one ton per day average rate.

Impregnation Seals Porous Castings

By Conrad H. Knerr, *Metallurgical Engineer*
Metlab Co., Phila., Pa.

Editor's Note: There are now available to industry a number of methods used to insure density and freedom from porosity in iron castings which might need to resist leakage under pressure. They are commonly described as "impregnation" methods and the demand for this service in conjunction with heat treating operations has been extending. Some heat treating departments and commercial plants have installed the equipment and the author describes and illustrates in detail one such recent installation.

A molten metal usually contains gases in solution. Cooling and freezing reduces solubility and the gases tend to separate in the form of miniature bubbles and channels, many of which are entrapped in the solidifying mass. This results in porosity in commercial castings. Dampness in sand molds and cores contribute further to porosity by the liberation of steam upon contact with hot metal.

This condition is very common in castings of aluminum, magnesium, bronze, brass, iron and steel. It does not greatly affect the strength in most cases, but is a serious defect where the product is required to withstand liquid or gas pressure without leaking, as in valves, fittings, instrument parts, fuel lines and many other applications.

Improvements in foundry practice and design can usually reduce, but seldom eliminate, this problem. It has been estimated that 20% to 70% of all castings for pressure service are rejected because of leakage. This is exceedingly wasteful, particularly when the trouble is not discovered until after costly machining work has been done.

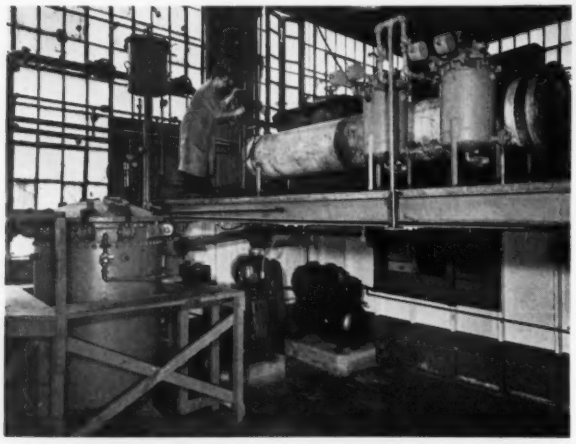


Fig. 1—General view of impregnation installation. Note two-level arrangement for gravity drainage.
Lower left—Liquid storage tank.
Lower center—Stokes vacuum pump and Ingersol-Rand compressor.
Lower right—Control panel.
Upper left—Vapor trap and vacuum piping.
Upper center—Operator checking the high vacuum on a Stokes McLeod Gauge.
Upper right—Various autoclaves.

Early attempts to salvage such material by impregnation were only partially successful and subject to many drawbacks. For example, a simple impregnation by dipping in a sealant results in very little if any penetration of the sealant into the pores, and produces an objectionable residue or deposit on machined surfaces and in threads and ducts. It could not be done until after machining.

The early practice of allowing cast iron castings to rust and oxidize in the yard for a long period produced at best a very low pressure seal and was highly wasteful of time.

An improvement in impregnation procedure came with the development of pressure techniques, applied to individual castings. Each opening but one was closed and the impregnant was poured into the casting. Pressure was then applied, by air or otherwise, until the impregnant oozed through the porous

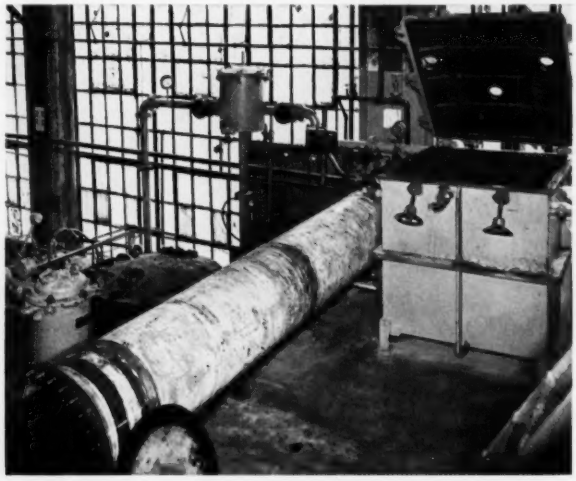


Fig. 2—View of the high vacuum autoclaves now in use, showing the vacuum piping and gauges in the background.

walls. This resulted in thorough impregnation and is still a suitable method for large individual castings which are hollow. But the method is slow and cumbersome and, therefore, prohibitively expensive for large numbers of small pieces.

At the same time, the impregnants being used were subject to many drawbacks. Sodium silicate or "water glass" was not suitable for the very fine micro shrinkage in magnesium castings and the fine leakage found in some aluminum castings. Its solubility in liquids and a tendency to break down also limited its use. Tung oils required elevated temperatures for their application. The early thermosetting resins contained volatile constituents which passed off in the curing operation and, therefore, left the pores only partially filled.

Military requirements and the increased use of light metal castings for pressure applications intensified the search for faster, cheaper and more reliable techniques and materials.

Several improved methods and impregnants were developed. Foremost among these is the high vacuum batch process, using Permafil as the impregnant.

Permafil, a product of the General Electric Company, is one of a new group of liquid synthetic resins, which converts to a hard, infusible solid through the action of a catalyst and heat. It is a fluid of low viscosity which completely penetrates porous structures. When heated Permafil solidifies and seals the pores.

Its distinguishing characteristic is that it contains no solvents, and converts completely to a solid state

Fig. 3—View of the curing oven and work. Author inspecting aluminum castings after treatment. On lower shelf are shown several cast iron pipe fittings.

when cured, releasing no vapors, and thus insuring freedom from voids or "resin porosity".

Permafil leaves no stain on finished surfaces and does not interfere with subsequent machining or painting operations. It withstands high pressures, temperatures up to 300°F., and does not react with most industrial liquids and gases. After curing it is appreciably soluble only in hot, strong caustic or alkaline solutions.

Permafil is applicable to all metals in common use, and to many other materials, such as wood, paper and fabrics.

The high vacuum batch process has made impregnation fast, cheap and reliable, particularly where many small castings are involved.

The parts are placed in an autoclave and a high vacuum is drawn in the chamber. A vacuum of 1000 microns* and better is held for approximately one half hour per inch of casting wall thickness, drawing

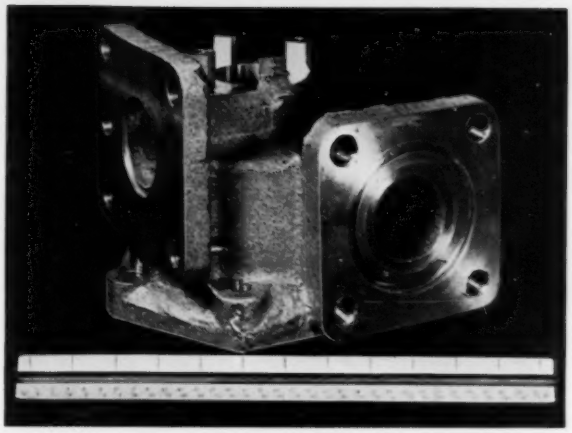


Fig. 4—A cast bronze valve body for high pressure air service. Impregnation leaves machined surfaces clean and does not foul threaded holes or passages.

all air and moisture out of the pores.

Liquid Permafil is then admitted until the parts are fully immersed, after which the vacuum is released and pressure applied to the bath by admitting compressed air to the top of the chamber. This is held for one or more hours, giving time for the impregnant to fully penetrate.

High pressure is neither necessary nor desirable because the previous *very high vacuum* has already removed air and moisture from the pores so that the Permafil, with its low viscosity and its capillary action, aided by a moderate external pressure, automatically fills the spaces completely and remains there.

Attempting to force the impregnant into the cavities by means of high external pressure, without first fully evacuating all volatile material would simply result in a piston action which would afterward force the fluid out again.

After treatment the castings are drained, washed, dried and cured.

The capillary action of the pores prevents loss of the resin during these operations.

The Permafil process produces clean, permanently sealed castings showing no discoloration or change in critical dimensions. It is approved in Government specifications and is written into the procurement specifications of many castings for military and civilian use. It may be employed as a preventative rather than merely a salvage procedure to eliminate leaking, thus simplifying foundry and manufacturing cycles and reducing overall costs.

In connection with its work in the commercial heat treatment of metals, including castings of many kinds and sizes, METLAB CO. has introduced impregnating service.

Permafil is the principal impregnant, but others are used for special services, particularly where high temperature will be encountered in operation.

The accompanying views illustrate the apparatus in METLAB's impregnating department.

* 1000 microns equals 1 mm. of mercury pressure. 1 atmosphere equals approximately 30 in. or 760 mm. 1000 microns, therefore, equals 1/760 of an atmosphere or about 0.13% of normal atmospheric pressure.

Carbide Segregation As Related to Tool and Die Life

EDITOR'S NOTE: The following article presents some interesting information concerning the ability to control carbon segregation in tool steels. It would be interesting, however, to secure from users of such metals any service record data concerning improved cutting life and actual comparisons with brittle metals which in some cases performed adequately. The editor invites any comments for such information.

By STEWART G. FLETCHER, *Chief Metallurgist*
And DAVID HUGHES, *Metallurgist*
Latrobe Steel Company

Carbide segregation has a marked deleterious effect on the physical properties of high alloy tool steels, such as all high speed steels, and the high carbon-high chromium die steels. For a long time this fact has been known by both the steel manufacturers and tool makers; however, little information has been published on the relative magnitude of this effect.

The influence of carbide segregation is not confined to physical properties alone; it reflects itself in production life of tools and dies as well. Reports received from a large number of tool and die manufacturers consistently point out the improved production records of tools free from carbide segregation. One large steel products fabricator stated that on a difficult punch and die application involving the use of 1.50% carbon, 12% chromium air hardening steel, production with conventional steels average 300,000 pieces per grind with a considerable amount of chipping and breakage encountered. Production with segregate-free steel of the same chemical analysis and on the same operation averaged 1,600,000 pieces per grind without any chipping and very infrequent breakage.

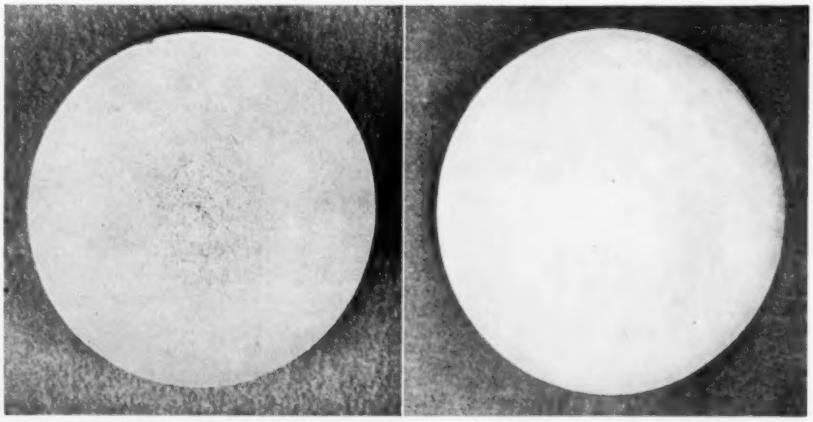
There are two general types of carbide segregation; microsegregation and macrosegregation. Microsegregation refers to the carbide concentration gradient across a group of a few grains or crystals of metal, while macrosegregation refers to the gradient across the entire mass involved, e.g., the cross section of the bar. The latter is the type of segregation to be discussed in this article.

Carbide segregation occurs initially during the freezing of the molten steel in the ingot. While in the liquid state, the metal is a homogeneous molten mass consisting of the various alloying elements dissolved in the iron. Immediately upon casting however, selective freezing begins so that the first crystals to solidify are those which have the composition corresponding to the highest freezing temperature. As solidification continues, the liquid with an altered composition and lower freezing point gravitates toward the center of the ingot, which is the last portion to freeze. It is here in the ingot center that the alloy carbide particles are forced to solidify and it is here that segregation is most severe. True, subsequent mechanical hot working of the ingot diffuses and breaks up the segregate to a limited extent, but unless considerable upsetting is employed, traces of segregation persist even though the steel is worked down into small sizes. Because segregation is a natural process, both manufacturers and consumers of high alloy steels heretofore have agreed that some segregation is to be expected in all tool steels, however deleterious it might be. Relatively recent improvements in manufacturing techniques have altered the standards for carbide segregation until today there is no longer any necessity for the use of high alloy tool steel containing excessive carbide segregation.

There are two generally accepted tests for determining the degree of segregation present in high alloy tool steels: the hot acid etch test and the harden, polish and etch test. The former consists of selectively etching a representative sample in a hot acid solution and interpreting the etching pattern produced on the sample. Figure 1 is an illustration of two such hot acid etched discs; one showing a considerable degree of segregation and the other exhibiting but little.

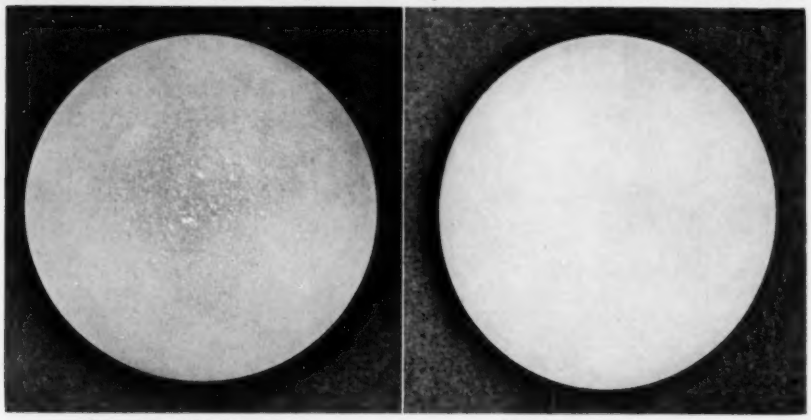
Inasmuch as the acid attacks constituents other than the segregated alloy carbides, thus affecting the overall pattern produced, the harden, polish, and etch test was developed to show more selectively the degree of segregation. Briefly, this test consists of hardening and tempering a representative sample of the steel, polishing until a mirror finish is obtained, then etching in a 5% nitric acid in alcohol solution for several minutes, which darkens the matrix and leaves the carbides unaffected by the etchant. Segregation can readily be seen with the unaided eye. Figure 2 shows discs of segregated and non-segregated steel prepared for examination by this method. An additional advantage of using this technique is that the treated test sample shows

Fig. 1—3" Round M-2 Type High Speed Steel subjected to the Harden, Polish, and Etch Test.



Heavy Carbide Segregation **Non-Segregated Sample**

Fig. 2—3" Round M-2 Type High Speed Steel subjected to the Harden, Polish, and Etch Test.



Heavy Carbide Segregation — Non-Segregated Sample

exactly the conditions to be expected in the finished, hardened tools rather than the annealed condition as revealed by the hot acid etch test.

Before the introduction of its "DESEGATIZED" tool steels to the market several years ago, the Latrobe Steel Company set out to study the effect of carbide segregation on the properties of alloy steels. Numerous laboratory tests as well as field tests were conducted to study such factors as toughness, dimensional stability, machinability, and reaction to heat treatment of both segregated and non-segregated ("DESEGATIZED") high speed and high carbon-high chromium steels.

A commonly used test to measure the toughness of steels is the impact test. Although impact tests are not the entire answer to the problem of toughness, they do measure a definite factor related to resistance to shock and in this way give an indication of dynamic toughness. In this study, the unnotched Izod impact test was used exclusively and the procedures followed those given by A.S.T.M. Specification E23-47T.

In a series of closely controlled tests, it was possible to show clearly the effect of segregation on the impact strengths of T-1 and M-2 high speed steels. These data are presented in Table I for T-1 and Table II for M-2 steel (Page 8).

Similar tests conducted on other types of commonly produced high speed steel analyses and high carbon-high chromium die steel analyses exhibited impact strengths 20% to 40% higher for non-segregated material as compared to heavily segregated material.

In order further to confirm this effect, two flat bars of ¼ inch thick by 3 inches wide M-2 type high speed steel were made with different degrees of segregation. Izod impact samples were cut from these bars in both longitudinal and transverse directions. After heat treating to Rockwell C 65 the impact strengths were found to be as shown in Table III (Page 8). These data further confirm the adverse effect of carbide segregation on the toughness of high alloy tool steels.

The influence of segregation on the dimensional stability through heat treatment was studied on an oil hardening high carbon-high chromium steel and on two high speed steels. Standard Navy distortion ring test specimens were machined, as shown in Figure 3, from both segregated and non-segregated 2.20% carbon, 13% chromium steel. The various dimensions were carefully determined in the annealed condition, as quenched condition, and after tempering over a wide range of temperatures. Since the "C" dimension is generally conceded to be the most sensitive to distortion, and for the sake of clarity, only the changes in this dimension are reported. Identical trends were found throughout all the other dimensions however. Table IV (Page 8) contains the results of this test.

Spline broach blanks 48 inches long machined from segregated and non-segregated T-1 and M-2 high speed steels were heat treated according to standard practices at three independent sources. Careful measurements were made so that the effect of segregation could be studied on the distortion characteristics. The average distortion experienced in the non-segregated T-1 steel blanks was 61.5% less than in the segregated blanks. The improvement shown by the non-segregated M-2 steel blanks was even more pronounced, the distortion being 83% less than that of similar segregated blanks.

All of these tests clearly indicate that carbide segregation definitely aggravates the distortion and warpage encountered in normal heat treatment of alloy steels.

Excessive segregation also has an influence on the machinability. It is not unusual to encounter so called "hard spots" when machining near the centers of tool steel bars. Usually these "hard spots" are attributable to clusters of hard alloy carbides rather than to improper annealing of the steel as a whole.

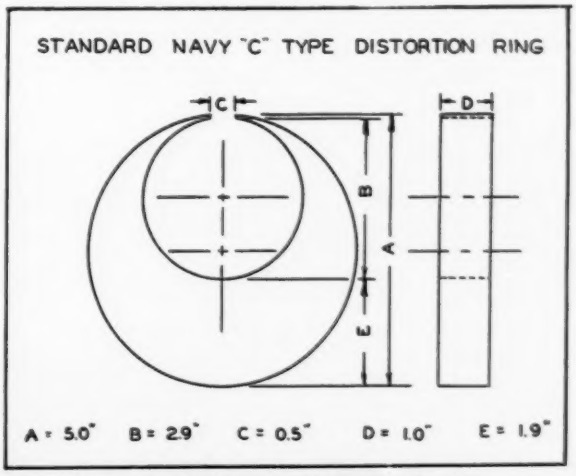


Fig. 3—Standard Navy "C" Type Distortion Ring.

These hard clusters chip and dull the edges of the cutting tools leading further to impaired machinability as cutting progresses.

When it is realized that agglomeration of the carbides near the centers depletes the outer areas of the steel of their fair share of carbide particles, it is not difficult to visualize that structural variations exist across these sections. Naturally this results in non-uniform solution of the carbides during heat treatment and non-uniform abrasion resisting qualities during operation. Excessive variations in hardness across a section of a tool and die can usually be traced to macrosegregation. All too often blanking dies will show tremendous variations in production results from grind to grind. These wide divergences are due in part to carbide structural inhomogeneities from layer to layer as the die face is reground.

When the microstructures of properly heat treated samples of segregated and non-segregated similar

Fig. 4—Microstructure in Segregated Area of 3" Round Sample of M-2 Type High Speed Steel. (Mag. 750 X)

analysis steels are examined, some of the reasons for the marked influence of segregation on the physical properties become readily apparent. Figure 4 illustrates the structures found during microexamination of properly heat treated but heavily segregated M-2 high speed steel. The area shown is representative of the structure adjacent to massive segregation and contains large amounts of retained austenite and untempered martensite. If examined as quenched, a coarse and duplex grain size is apparent as well. All of the undesirable properties of these constituents—brittleness, susceptibility to grinding damage, non-uniform hardness, and varying degrees of abrasion resistance—become an inherent part of the tool or die. This condition persists even after multiple tempering and so cannot be alleviated in any manner by variations in heat treatment.

In conclusion, it can be stated that carbide segregation because of its influence on physical and mechanical properties *undoubtedly* exerts a tremendous effect on tool and die life. While carbide segregation was once accepted as a necessary evil in all high alloy tool steels, modern production techniques have so improved the quality of tool steels that valuable production life need not be sacrificed any longer because of these structural inhomogeneities.

Table I
Influence of Carbide Segregation on Impact Strength of T-1 High Speed Steels

Tempered at °F	Hardness Rockwell C	Unnotched Izod Group A Little or No Segregation ft.-lbs.	Impact Strength Group B Some Segregation Present ft.-lbs.
950	64.0	28	17
1000	65.0	24	18
1050	65.0	27	17
1100	64.0	26	17
1150	61.5	28	19

Material: T-1 high speed steels, ½ inch square bar stock.
Heat Treatment: Hardened from 2350°F, 3 minutes at temperature in electric muffle furnace, oil quenched. Tempered 2 + 2 hours at indicated temperatures.
Intercept Grain Size: 10.8.

Table II
Influence of Carbide Segregation on Impact Strength of M-2 High Speed Steels

Tempered at °F	Hardness Rockwell C	Unnotched Izod Group C Little or No Segregation ft.-lbs.	Impact Strength Group D Some Segregation Present ft.-lbs.
1000	65.5	41	23
1050	65.0	39	27
1100	63.5	32	28
1150	59.0	41	28

Material: M-2 high speed steel, 7/16 inch square bar stock.
Heat Treatment: Hardened from 2250°F, 3 minutes at temperature in electric muffle furnace, oil quenched. Tempered 2 + 2 hours at 1050°F.
Intercept Grain Size: 11.2.

Table III
Influence of Carbide Segregation in Flat Bar Stock on Impact Strength of M-2 High Speed Steel

	Unnotched Izod Group E Little or No Segregation ft.-lbs.	Impact Strength Group F Definite Center Segregation ft.-lbs.
Longitudinal, near edge	29	30
Longitudinal, center	30	25
Transverse, break at center	31	16

Material: M-2 high speed steel, ½ inch by 3 inches flat bars, sectioned into impact test samples.
Heat Treatment: Hardened from 2250°F, 3 minutes at temperature in electric muffle furnace, oil quenched. Tempered 2 + 2 hours at 1050°F.
Intercept Grain Size: Group E — 10.4.
Group F — 10.2.

Table IV
Influence of Carbide Segregation on the Dimensional Stability Through Heat Treatment of Oil Hardening, High Carbon-High Chromium Steels

Tempering Temperature °F	Hardness Rockwell C	Improvement Resulting in Freedom from Segregation* Percentage
As Quenched	65.0	13
300	63.5	18
500	60.5	26
700	59.0	15
900	57.5	3

*Measurements made on "C" dimension of Navy distortion test.
Material: 2.20% carbon, 13.00% chromium steel; 5½ inch round bar stock.
Heat Treatment: Fully annealed after machining but prior to obtaining measurements. Hardened from 1750°F, 30 minutes at temperature in controlled atmosphere furnace, oil quenched to 400°F, then air cooled to room temperature. Tempered 2 hours at temperatures indicated.

News to Heat Treaters...

Rotary Hearth Dry Cyanide Gives Light Case to Transmission Gears

Pinions and gears for Buick Dynaflow automatic transmissions are case hardened in a Surface Combustion Rotary Hearth Furnace that is equipped with radiant tubes and a recirculating fan. Enriched RX prepared atmosphere gas provides active cyaniding medium.

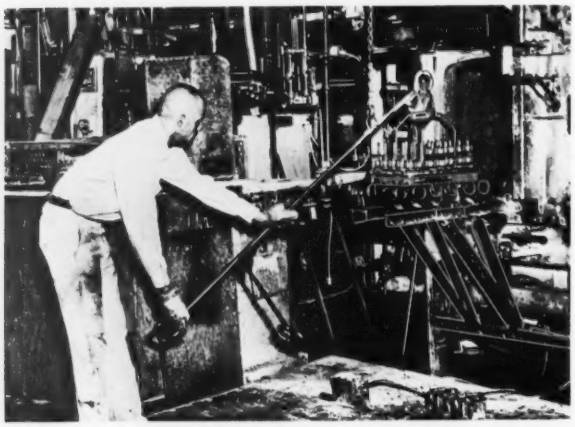


Fig. 1—Charging Surface Combustion rotary hearth furnace with pinions and gears. Quench tank next to operator.

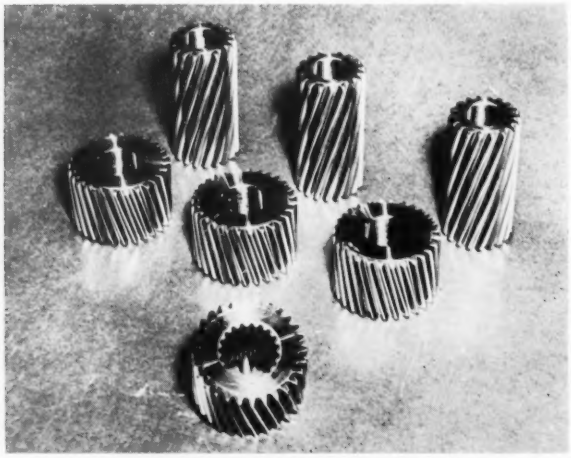


Fig. 2—Pinions and gears of SAE 4620 treated in enriched RX gas atmosphere.

The gears, of SAE 4620, are heated to 1550°F. in this 12 foot diam. rotary furnace and quenched in nitrate bath at 410°F. The rated production capacity is about 612 lbs. per hour, net of pinions and gears.

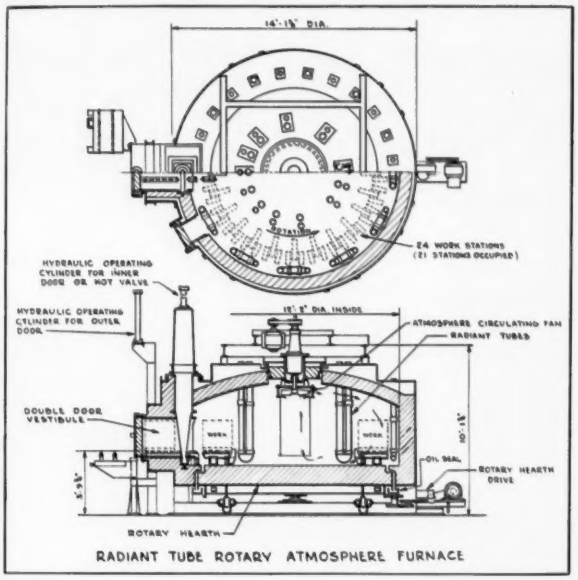


Fig. 3—Cross-section of rotary hearth furnace showing radiant tubes and work handling facilities.

* * *

125 Acres Bought By L-N

The purchase of a 125-acre tract of land at North Wales, Pa., in the Philadelphia suburban area, has been announced by Leeds & Northrup Company, manufacturer of electrical measuring instruments, automatic controls, and heat-treating furnaces.

Although ultimate use of the tract remains to be determined by engineering surveys, according to C. S. Redding, president, the company contemplates moving to the new location certain operational or laboratory units from its main plant in Philadelphia.

* * *

Capacitor Installation

A power cost saving of approximately $150 per month resulted from the recent installation of 12 General Electric capacitors at the plant of the Montrose Chemical Corporation of California, an affiliate of the Stauffer Chemical Company in Los Angeles.

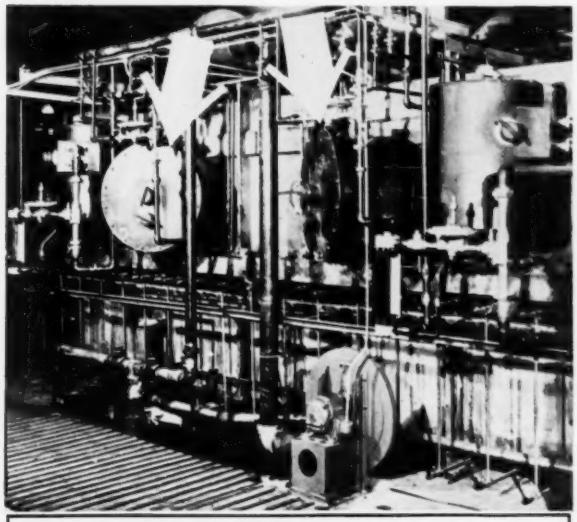
Each of the capacitors is rated at 15 kvar, 3 phase, 60 cycles, 460 volts and is complete with fuses in the terminal box.

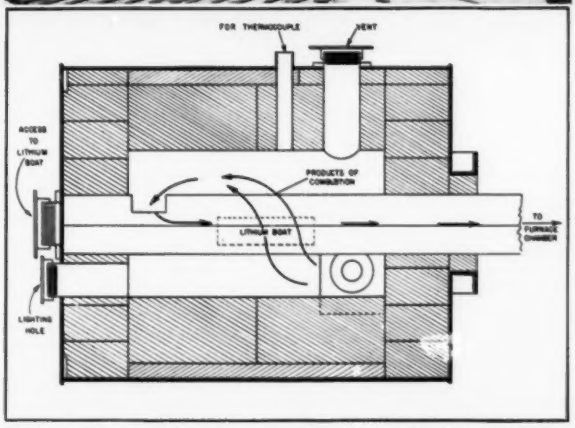
Originally, the units were installed to reduce the overload on transformers serving the plant, caused by rapid plant expansion. Installation of the capacitors brought the plant's power factor up from approximately .76 to .976, bringing about the monthly saving.

Lithium Hot Atmosphere Increases Furnace Output and Cuts Pickling Costs

The Lithium Company, of Newark, N. J., has developed the Lithium HOT ATMOSPHERE system for application to any indirect-fired furnace now being used without protective atmosphere. With a small capital investment, conversion to Hot Atmosphere results in increased furnace output and a considerable cost reduction in pickling and cleaning after annealing or normalizing.

A recent installation of the Hot Atmosphere system in the conversion of a continuous roller hearth furnace for annealing welded stainless steel tubing is a case in point. The primary reason for converting this furnace to Lithium Hot Atmosphere was to provide a high degree of protection against scaling or oxide formation on the surfaces of the stainless steel tubes during annealing or normalizing. Previous practice has been to anneal the tubes in a gas-fired,





Lithium Hot Atmosphere System applied to a roller hearth furnace.

radiant tube, continuous furnace. Despite this provision for indirect heating to avoid contamination by the products of combustion, oxide formation on the tube surface was quite heavy, requiring an elaborate and costly operation of pickling and cleaning after each anneal. The installation of Lithium Vaporizers in conjunction with standard exothermic gas cracking chambers, attached to the furnace, provided the means for protecting the surface of the work and for adding heat to the furnace.

The Lithium vapor, produced by heating the Lithium compound in the Vaporizer, mixes with the products of combustion gases resulting from the heating. This HOT mixture together with the HOT exothermic atmosphere from the gas cracker is distributed throughout the furnace to provide the necessary surface protection for the tubing. Production of more consistent surface qualities, as well as the protection against scaling, reduced the cleaning cost and time considerably—as much as 65%. The loss due to rejects was also decreased considerably.

Because the atmosphere is hot, it obviously adds a considerable amount of heat to the furnace both by conduction and convection to supplement the normal heat supplied by the radiant tubes. It thereby increases furnace productivity considerably. Moreover, the hot Lithium atmosphere causes work entering the furnace to come up to heat far more readily than in conventional atmosphere furnaces or in indirectly heated furnaces operating without any atmosphere.

The fuel saving derived from direct utilization of the HOT gases from the exothermic generators and Lithium Vaporizers is significant because virtually the entire heat potential resulting from preparing the atmosphere is available for heating the work within the furnace chamber and is not wasted, as it would be with exothermic systems, where the gases run through cooling systems.

Depending on the material to be heat treated, Lithium coated tubes can be cold worked with a fine resulting finish, without being pickled or cleaned.

This Lithium HOT ATMOSPHERE system has a wide range of application in the conversion of indirect-fired furnaces which are now being operated without a protective atmosphere.

* * *

Annual Meeting Society of Non-Destructive Testing, Inc.

The annual meeting of the Society of Non-Destructive Testing will be held at the Hotel Sylvania, Philadelphia, Pennsylvania, October 20 thru 23.

Preview of the program indicates a very comprehensive schedule directed to the needs of industrial management. Papers to be presented will show the basic ways in which non-destructive testing can lower operating costs. Members from all over the country will be in attendance.

* * *

Aluminum Coating Steel

A new dipping process for coating steel with aluminum has been developed by General Motors Corp., General Motors Bldg., Detroit 2, Michigan. Called "Aldip," technique may lead to replacement of some zinc coated metals and when diffused by heat treatment, it becomes heat resistant. Parts are cleaned, dipped in bath of preheating salt, transferred to an aluminum bath which is covered by layer of salt flux, returned to salt bath, and slowly raised.

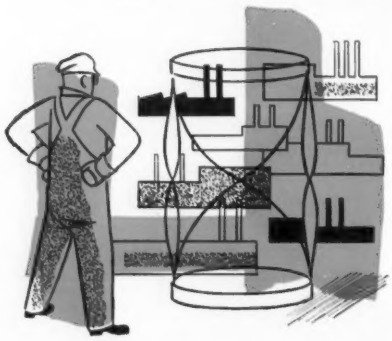
(Continued on page 14)

When you require the BEST in Heat Treatment of Metals add a MTI Commercial Heat Tr Plant to your facilities

Today's industrial production picture is placing increasing emphasis upon all forms of heat treating. This is true in military manufacturing where high specifications must be met and in civilian output where commercial and substitute metals must be used. Demand for heat treating services has more than doubled in a single year—a demand which is being met in the plants of the members of the Metal Treating Institute, the leading commercial heat treaters in the United States.

There are *3* basic reasons why, when you require heat treating service, you should consult a commercial plant first:

1. ***He offers under one roof complete service for all basic types of heat treating processes.***



2. ***His skills and equipment have been developed over years of meeting industry's needs.***

3. ***As an MTI member he is a leader in the field—known for quality—service—technical ability.***

Treating

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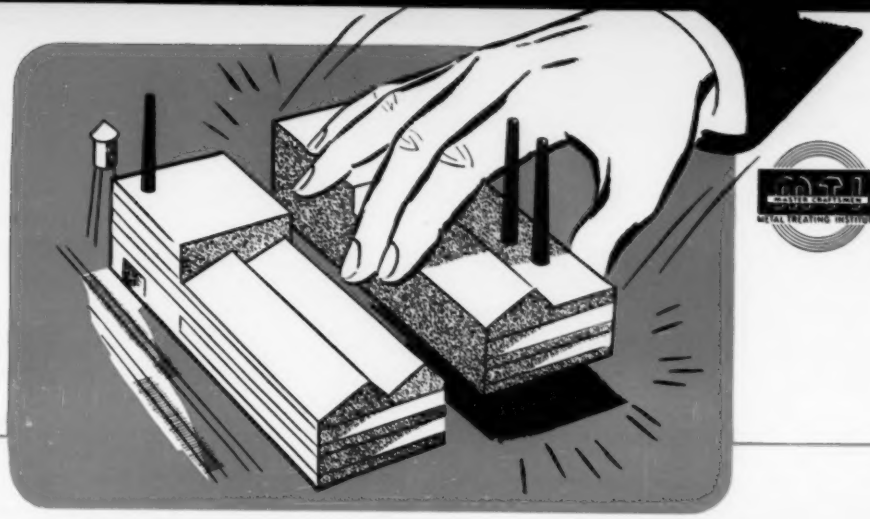


For the BEST in Heat Treating Consult these Companies:

CALIFORNIA

California-Doran Heat Treating Co.
2850 E. Washington Blvd., Los Angeles 23
Cook Heat Treating Corp.
5934 Alcoa Ave., Los Angeles 11
Hollywood Heat Treating Co.
1046 No. Orange Drive, Los Angeles 38
Lindberg Steel Treating Co.
3537 East 16th St., Los Angeles 23
Dexter Metal Treating Co.
1026—77th Ave., Oakland 21
Industrial Steel Treating Co.
1549—32nd St., Oakland 8

COLORADO

Metal Treating & Research Co.
651 Sherman St., Denver 3

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 5

ILLINOIS

Seneeca Heat Treating Co.
70 S. Batavia Ave., Batavia
Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Chicago Steel Treating Co.
333 North California, Chicago
Dura-Hard Steel Treating Co.
2333 West Deming Place, Chicago 47
Lindberg Steel Treating Co.
222 North Laflin St., Chicago 7
Pearson Industrial Steel Treating
5757 Ogden Ave., Chicago 50
Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kenzie St., Chicago 22
American Steel Treating Co.
P. O. Box A, Crystal Lake
Eklund Metal Treating, Inc.
721 Beacon St., Love Park
O. T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford

INDIANA

Nerl Heat Treat Corp.
1824 So. Franklin St., South Bend 23

MARYLAND

Maryland Tool Company
111-13 Hollingsworth St., Baltimore 2

MASSACHUSETTS

New England Metallurgical Corp.
9 Alger St., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Anderson Steel Treating Co.
1337 Maple St., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Michigan Steel Processing Co.
3120 Denton, Detroit 11
Standard Steel Treating Co.
3468 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit

MINNESOTA

Metallurgical Control Labs.
2226 East Lake St., Minneapolis 7

MISSOURI

Metallurgical, Inc.
1915 Tracy Avenue, Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Heat Treating Co.
611 Grove St., Elizabeth
American Metal Treatment Co.
Highway 25 and LaFayette St., Elizabeth
Benedict-Miller, Inc.
Marin Ave. and Orient Way, Lyndhurst
Bennett Steel Treating Co.
246 Raymond Boulevard, Newark 5
L-R Treating Co.
107 Vesey St., Newark

NEW YORK

Fred Heinzelman & Sons
138 Spring St., New York 12
Alfred Heller Heat Treating Co.
391 Pearl St., New York 7
Metro Heat Treat Corp.
466 Broome St., New York 13
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Cincinnati Steel Treating Co.
Wooster Pike & Mariemont Ave.,
Cincinnati 27
Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 25
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1265-71 East 55th St., Cleveland 14
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 West Lake Road, Cleveland 16
Dayton Forge & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Limekiln Pike, Dresher
J. W. Rex Co.
834 West Third St., Lansdale
The Drever Company
220 West Cambria St., Philadelphia 33
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 East Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
4272 Wissahickon Ave., Philadelphia 32
Ferrotherm Company
4911 Butler St., Pittsburgh
Pittsburgh Commercial Heat Treating Co.
49th St. and A.V.R.R., Pittsburgh 1

TEXAS

Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11

WISCONSIN

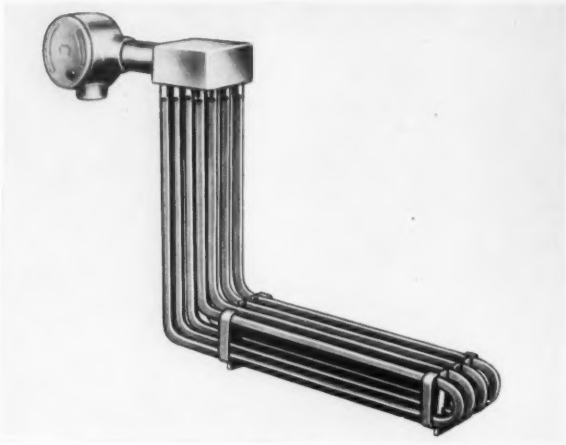
Wesley Heat Treating Co.
825 South 21st St., Manitowoc
Hushek Metal Processing Co.
1536 West Pierce St., Milwaukee
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wesley Steel Treating Co.
1301-1403 West Pierce St., Milwaukee
Harris Metals Treating Co.
1745 Taylor Ave., Racine
Spindler Metal Processing Co.
2338 Mead St., Racine
Wesley Metal Treating Co.
2320 Mead St., Racine

Improved Electric Heaters

Improvement of two Chromalox industrial electric heaters used in the chemical, plastics, and metal working industries has been announced by Edwin L. Wiegand Co., Pittsburgh 8, Pennsylvania.

Design of Chromalox type TBL electric tank heater now includes a vapor-tight terminal box as a standard feature. Heavy duty Chromalox tubular elements are welded to the sealed, electrical connection housing and the wiring is brought out to the terminal box through a thick-walled steel pipe.

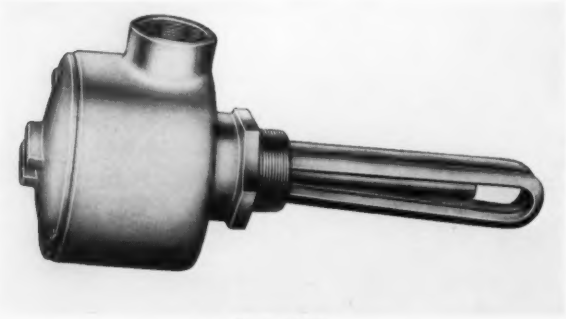
The new construction is intended to give longer, safer usage of the units in the presence of corrosive



Type TBL

and penetrating vapors. Typical uses are heating tempering oil and caustic soda degreasing baths; for melting tin, babbitt, solder, and similar soft metals; in the chemical and plastics industries for heating transfer mediums, such as molten salt, lead, or oil.

Chromalox TBL units are available in steel, alloy, or stainless with ratings from 3 to 7.5 Kw. Heated height ranges from $11\frac{1}{8}$" to $43\frac{3}{4}$" and length of feet from $13\frac{7}{16}$" to $25\frac{9}{16}$".



Type ARMT

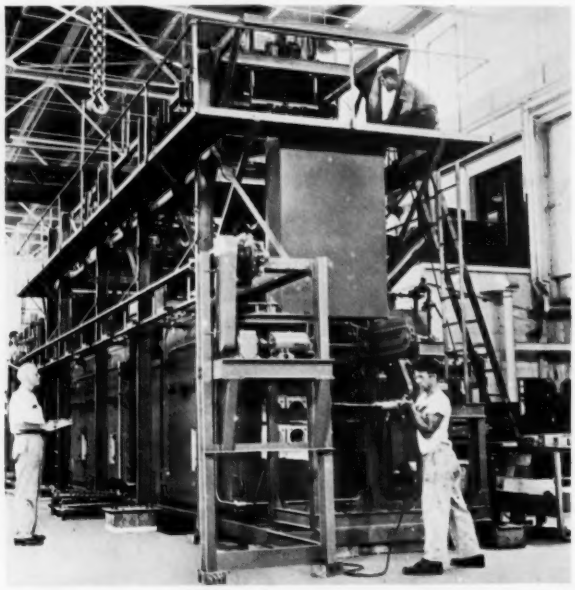
The type ARMT screw-plug unit with explosion-proof or vapor-tight terminal box is now available with wider built-in thermostatic range. With brass or copper construction for water heating the range is from 50° to 250°F.; with steel for oil heating it is 150° to 550°F. The type used for oil heating has a reduced "heat intensity" to prevent carbonization of oil on the sheath of the heater.

The ARMT unit is available with 2" and $2\frac{1}{2}$" standard pipe thread fittings in ratings from 1.5 to 10 Kw. Heated length of unit ranges from $7\frac{3}{4}$" to 48".

* * *

Special Automatic Gun Barrel Hardening, Quench and Draw Furnace

One of the completely packaged units being assembled in the large main bay of the Lindberg Engineering Company, Chicago, Ill., Plant No. 1.



The Gun Barrel Furnace, including automatic loading and unloading devices, is 42 feet long, 10 feet wide and 19 feet high.

* * *

New Hardening Treatment

Hard - N - Tuff Steel Hardening Compound, manufactured by Doughty Laboratories, New York, is being used by a large eastern railroad to harden staple header dies made from AISI 1050 steel with the following results: The dies, which before hardening had begun to mushroom after ten (10) impressions, are now, after hardening, giving *400* satisfactory impressions.

(Continued on page 21)

Institute News . . .

METLAB ENROLLS APPRENTICES

Upon receipt of the approved form for Apprenticeship Courses, METLAB CO. announced, through the local newspapers and through the Veterans' Employment Bureaus, its desire to receive applicants. Response from both sources was good and the Company now has eight (8) Apprentices enrolled, with possibly more to come.

Believing, as stated in conferences with Government authorities, that it would be difficult to get applicants in satisfactory number and quality to commit themselves to a four year training program, and being convinced that satisfactory training for a journeyman heat treater can be conducted in two years under an intensive program, rather than the four years permitted under the approved program, METLAB CO. proposes to make it possible for men of special ability to qualify within two years.

Toward this end an intensive schedule of shop experience, including ten different divisions of work in the Plant, has been set up. Two graduate Metallurgical Engineers from the METLAB staff have been assigned as special instructors for the Apprentices. Prior to the opening of Evening Courses, special introductory classes for these Apprentice students are being held at the METLAB Plant every working day from 4:00-5:00 P.M., at which time practical instruction on the processes, operations and equipment at the Plant are given by one or both of these instructors. Daily quizzes are included.

Upon the opening of the evening classes in Physical Metallurgy at Temple University, all apprentices will be required to enroll, to comply with the requirement for regular scholastic work.

For many years this course has been conducted at Temple under the auspices of the Philadelphia Chapter, ASM. It takes two years, two nights weekly for thirty weeks from October to May each year. The first year is devoted to lecture and laboratory work in which the student learns the basic scientific principals of physical metallurgy, the application of these principals and the use of the tools of the metallurgical art in the laboratory. The second year's teaching is devoted to more advanced lectures on various aspects of ferrous and non-ferrous metallurgy, and to more advanced laboratory exercises. Upon completion of the two years work with satisfactory grade, Temple University grants the student a Certificate of Proficiency. Holders of this Certificate are believed to have all the necessary theoretical information which a first class journeyman heat treater may need, including a grounding in elementary physics and chemistry, the electrical operation of pyrometers, the principals of optics in the use of the microscope, the principals of operation of tensile and hardness testing machines, the technique of metallographic work, as well as exercises in various kinds of heat treating.

METLAB will up-grade its apprentice students upon their performance in the shop as well as in their class work, both at the METLAB Plant and at Temple University.

Instead of paying only 50% of the journeymen's wage rate, as proposed under the official apprentice plan, METLAB CO. starts its apprentices at the full rate for labor, which is, of course, much more. If the student completes the apprenticeship course satisfactorily in two years he will then qualify for the full journeymen's rate. This would include any increase in such rate which took place during his two year tenure of employment.

Applicants are responding well to this program.

Apprentices work the regular 40 hour week with overtime, when approved, but attend all classes on their own time. METLAB CO. assists in financing the tuition fee for the Evening classes. There is, of course, no fee for classes at the Plant. The instructors are paid for their time by the Company.

* * *

The annual meeting of the Metal Treating Institute will be held October 17, 18 and 19 at the Hotel Warwick in Philadelphia, Pennsylvania.

The program will follow the outline below:

Friday—October 17—A.M.—Registration
President's Welcome
Speaker: FRANCIS TATNALL, Baldwin-Lima-Hamilton Corp.—*Testing As Related to the Heat Treatment of Metals*
Round Table Discussion of Heat Treating Insurance
General Business Meeting

Friday—P.M.—Speaker: V. H. FERGUSON, Ferguson Equipment Corp.—*New Developments in Heat Treating Equipment*
Committee Reports
Dinner Meeting of the Board of Trustees
Ladies' Day Program to be determined by Ladies' Committee

Saturday—October 18—Business Meeting
Speaker: WM. C. MEARNS, International Nickel Co.—*Some New Alloy Steels and Their Heat Treatment*
Round Table Discussion of Apprenticeship Program

Saturday—P.M.—Business Meeting—Committee Reports
Ladies' Bridge luncheon—Mrs. Horace Knerr, Hostess

Saturday Evening—Reception and Banquet

Sunday—October 19—A.M.—Luncheon at Metlab Company Plant (Ladies invited)

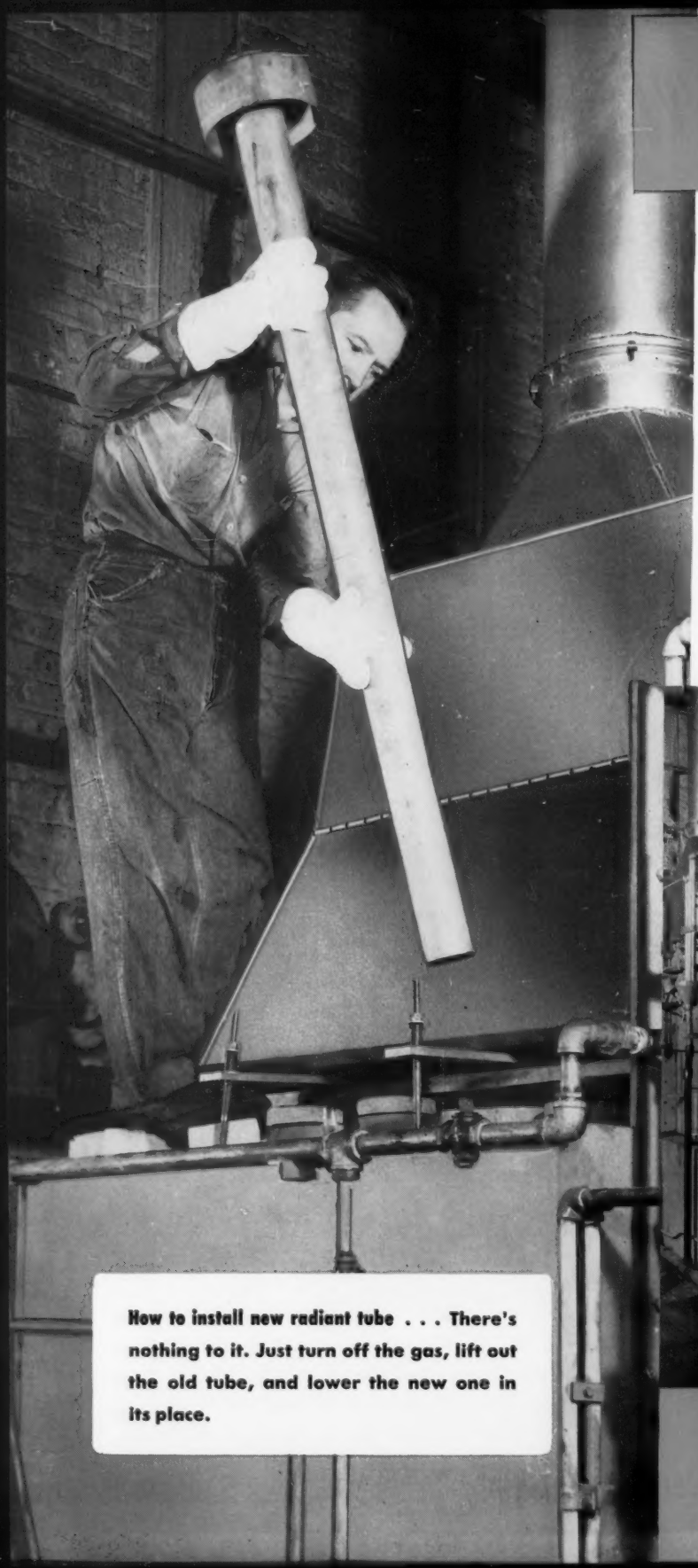
Sunday—P.M.—Reception and Clambake – President Walter Rex's home (Ladies invited)

(Continued on page 21)

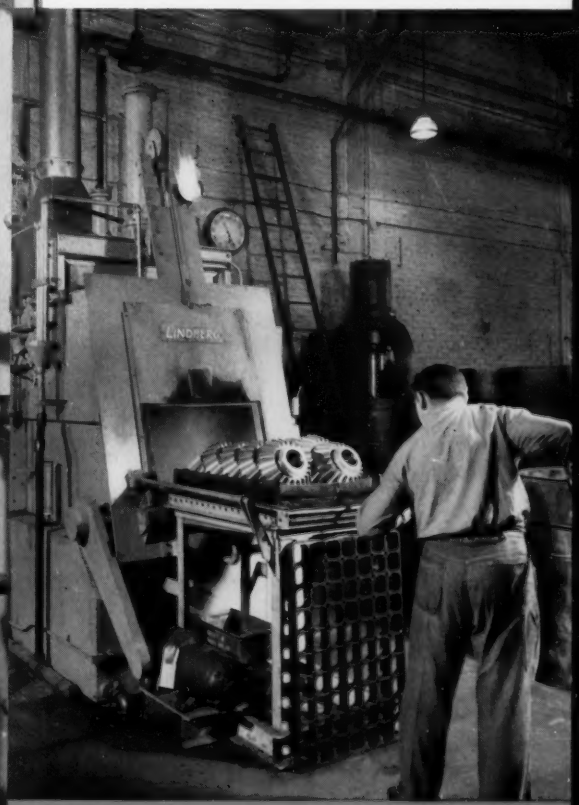
zip-zip . . . . . like in LINDBERG

Well, maybe not that fast . . . but it'll seem that fast if you've ever had to struggle around with the old type heavy radiant tubes. These new gas-fired, vertical tubes weigh only 29 pounds . . . almost as light as a razor blade by comparison.

All you do is turn off the gas, get on top the furnace, lift out the old tube, lower a new one in its place . . . and that's it.



How to install new radiant tube . . . There's nothing to it. Just turn off the gas, lift out the old tube, and lower the new one in its place.



The greatest advance in industrial furnace design and construction since Lindberg introduced the Cyclone forced convection tempering furnace back in 1935!

. change radiant tubes
blades in your razor!

CARBONITRIDING FURNACES

Simple, isn't it? No furnace cooling necessary . . . no extended down time . . . no clumsy plugs to unbolt . . . no squirming around inside the furnace.

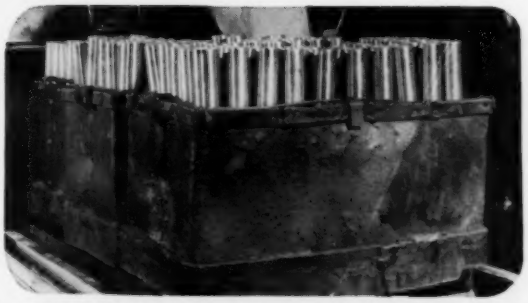
But ease of maintenance is only one of the advantages offered by this amazing Lindberg Carbonitriding Furnace. Check these important construction features:

Quench tank pit unnecessary . . . Your Lindberg Carbonitriding Furnace includes a built-in pitless quench tank . . . thus you avoid costly excavation and piping. But more important, this built-in quench tank minimizes distortion . . . quenching takes place within the furnace structure, by means of a vertically operated elevator. Heated charges are never exposed to the air . . . as would be the case if work had to be transferred from the heating chamber to a separate quench tank. Uniform case depth is assured because each charge automatically remains at heat the same length of time.

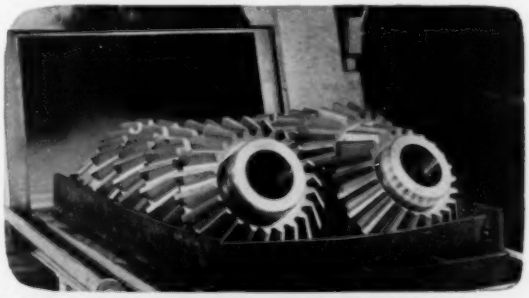
Preheat and purge chamber . . . Prior to entering the furnace heating chamber, work enters area immediately above built-in quench tank. Here, work is preheated . . . this reduces drastic temperature change when work enters heating chamber. Also, the work is completely purged while it is preheating.

Many furnaces in one . . . Furnace atmosphere is provided by Lindberg "Hyen" endothermic atmosphere generator that is easily adjustable to supply different atmospheres not only for carbonitriding, but also for carburizing, carbon restoration, bright hardening or annealing and normalizing. For annealing and normalizing the heated charge cools in the same chamber used for preheating and purging.

For additional information write your nearest Lindberg office . . . or Lindberg Engineering Company, 2466 West Hubbard Street, Chicago 12, Illinois.



CARBONITRIDING . . . Specifications called for .023 to .025" case on these low carbon seamless tubes. The charge weighed 450 lbs., and required 1¾ hours.



CARBURIZING . . . 450 lbs. of these bevelled gears, SAE 1020, required three hours total time to obtain a .032" depth.

ANNEALING . . . These SAE 1045 gear blanks were annealed to 174 Brinell. Temperature was 1550° F., time 1½ hours. The charge weighed 350 lbs. Cooling was in atmosphere.

LINDBERG  **FURNACES**

HEAT TREATING HINTS

PROTECT YOUR PROFIT MARGIN BY EFFICIENT HANDLING

Unnecessary duplication will eat into your profit margin. Never pick it up twice when once will do. Don't handle yourself out of a profit. Keep an eye peeled on your cost of handling production jobs being normalized, annealed or heat treated.

Size of material, plant lay-out, process and your production schedule will limit your flow, but most of us could find a better labor-saving way. (Fig. 1.) The ideal would be . . . incoming truck to furnace . . . furnace to outgoing truck. However our humble heat treat jobbing shops must be set up to meet average requirements of many customers. Time and production schedules for furnaces will seldom permit a direct flow. Your opportunity for saving time and labor is the intermediate points.

Fig. 1—Proper plant layout and location of equipment improves production efficiency. Note how work in process can be made to flow evenly.

If you can, mentally plan flow of production jobs before they are unloaded from the truck. Why put it on the floor when you intend to move it to furnace #8 later? Whenever possible use the proper container; crane or truck the container to the furnace. When unloading furnaces have the container under the furnace apron. The next path leads to the cleaning machine where the contents of the container is directly unloaded. In one operation the cleaning machine re-deposits the work into container or loader for shipping.

If straightening is your last operation the parts could readily be put into your customer's shipping container or your loader for one-operation loading in outgoing trucks.

Many plants have found that the installation of an inexpensive loading dock permitting loading and unloading at the floor level, will put money in the bank by cutting down handling costs through reduced labor and elimination of waiting time and cost of operation of heavy loading equipment or cranes. (Fig. 2.) Small power equipment can be utilized by carrying load directly to and from truck bed.

Fig. 2—This recently installed floor level loading dock has made a real contribution to efficient handling.

Overhead cranes, capable of serving the entire area of your shop, can be utilized for special heat treat jobs, moving and installation of equipment, loading and unloading of heavy parts to and from furnaces, trucks and freight cars, and other services of regular or special nature.

You are fortunate if your plant layout leads the part operation by operation a step closer to the shipping dock. Most of us just grew and are not so blessed. "The next best thing" is usually our goal. If you are aiming at increased productivity, holding the price line and improved service you won't want to overlook the possibilities of a better handle for your handling.

CHARLES H. HEWITT, *Dayton Forging & Heat Treating Co., Dayton, Ohio*

* * *

"COPPER CREEP" ELIMINATED

It was with considerable interest that I read the short account of "Trouble in Stop-Off Case Hardening with Copper Plating" in your July-August issue of Metal Treating. We experienced considerable trouble a number of years ago of a similar nature. We termed it "copper creep". On small critical parts we found that the copper would migrate as much as $\frac{1}{16}$" preventing ingress of carbon during carburizing in areas desired hard. In referring to a report dated April 3, 1934 we arrived at the same conclusion as Ruffle and Chawner. Briefly several observations contained in our report are given on page 19.

(1) Analysis of various carburizing compounds

	Sulphites (qualitative)	Sulphur (evolution)
Compound "A"	Nil	.020
Compound "B"	Nil	.020
Compound "C"	trace	.028
Compound "D"	trace	.032
Bone	Nil	.004

We found the bone satisfactory for all sizes of boxes. The other compounds were satisfactory regarding copper migration only when the containers were very small and the boxes charged when furnace was at carburizing temperature. We attributed the copper migration to the formation of copper sulphide which would spread out from the normal line of copper plate. As the temperature increased in the presence of CO this would be reduced to metallic copper. When the compound heated rapidly as in a small container the copper sulphide was probably broken down almost as soon as formed and the sulphur evacuated as SO_2. Practice established was to pack the work in charred bone and charge the boxes after furnace had reached carburizing tem perature. No further trouble was encountered. Since 1937 we have used gas carburizing and have had no difficulty with copper migration.

J. G. Morrison, *Chief Metallurgist, Landis Machine Co. Waynesboro, Pa.*

CLASSIFIED

Tests Show New Quench Oil has Intensified Triple Action

PARK'S Triple A Quench Oil has intensified triple action: 1. Rapid heat removal with faster cooling rate in the critical range giving higher and deeper hardness. 2. Slow cooling through the hardening range, minimizing distortion. 3. Great stability due to special anti-oxidants. Result is longer life and bright quenching properties.

An explanation of the quenching process illustrates how Park Chemical Company with over forty years of chemical and metallurgical background developed an ideal oil to fit the ever mounting production quenching problems.

Three stages of cooling are observed when steel is quenched in oil from a red heat. (A) Formation of a vapor film at the steel surface; cooling is accomplished by conduction and radiation through this vapor film and is relatively slow. (B) Direct contact of the oil with the metal surfaces causing a boiling action which continually dissipates the vapor film formed and results in rapid cooling. (C) After the metal has been cooled to the boiling point of oil, vapor is no longer formed; cooling is by conduction and convection, and the metal slowly cools to the temperature of the oil.

Although water and water solutions provide high cooling rates throughout these three stages of quenching, they are often impractical because rapid cooling is not desirable in the lower ranges of temperature where martensite is formed. It is at this time that temperature differentials within a piece of steel cause warping and cracking. Thus oil quenching is preferred for all steels possessing sufficient hardenability to avoid transformation to soft structures in stages A and B, since the cooling rates furnished by oils during Stage C are ideal for preventing temperature differentials.

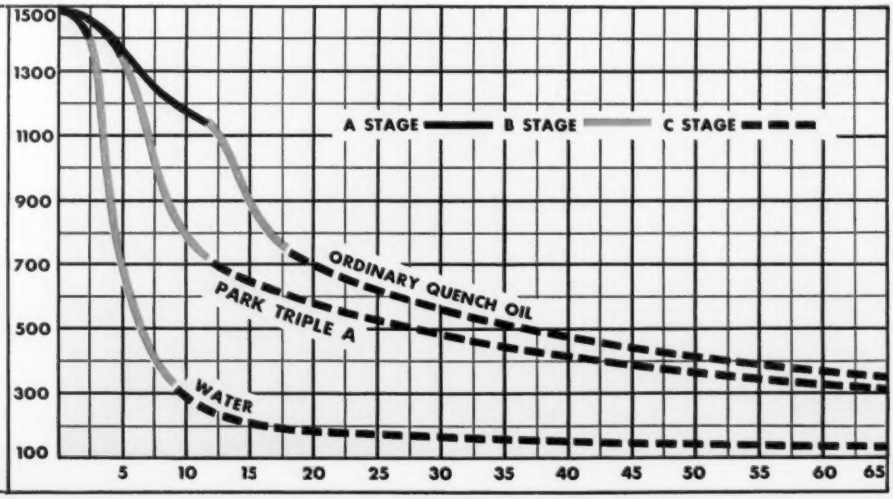
It is apparent that any improvement in the cooling power of oil in Stages A and B would be most desirable. Such improvement is obtained in water quenching by the addition of salt or caustic soda. The brine or caustic solution has a wetting action which completes the quenching job faster than fresh water. Fresh water takes hold only in spots causing non-uniformity. Brine solutions provide deeper and more uniform hardnesses. It seems logical to attempt to do this same thing with oil. The mineral intensifiers added to Park's Triple A Quenching Oil act in this manner.

The accompanying cooling curves serve to illustrate how this additive has altered the quenching power of the oil in the A and B stage, yet has retained the desirable slow cooling in the C stage.

This is the front page of a 4 page Technical Bulletin on Oil Quenching. For the complete bulletin write for Bulletin F-8.

A, B, C, stages in cooling curves showing advantages of Park Triple A Quench Oil. Samples quenched from 1500° F. in oil at 140° F. and water at 70° F. Steel SAE 1045 ½" dia. x 2" long.

Note: Chart is plotted in degrees F. on the ordinate and time in seconds on the abscissa.



NEW MEMBER

It is with pleasure that the Metal Treating Institute welcomes into membership Metallurgical, Inc., 1915 Tracy Avenue, Kansas City 8, Missouri, with Mr. Fred E. Fitzgerald, General Manager, who will be active in Institute activities. The company is a subsidiary of the Metallurgical Control Laboratories, 2226 East Lake Street, Minneapolis 7, Minnesota.

* * *

BUSINESS MANAGER

METAL TREATING, 271 North Avenue, New Rochelle, New York, recently announced the appointment of Richard N. Callahan to the post of Business Manager.

Mr. Callahan formerly served with the Reinhold Publishing Corp., of New York, as District Manager representing the American Chemical Society publications. He brings to METAL TREATING considerable knowledge of the publishing field, industrial markets and business relations.

* * *

PLANT VISITATIONS

Invitations have been extended to all members by Frank Rizzo of L-R Heat Treating, Newark, New Jersey, and Purdy Benedict and Harvey Miller of Benedict-Miller, Inc., Lyndhurst, New Jersey, to visit their plants on Thursday, October 16th, prior to the annual meeting. Arrangements are being made for transportation, luncheon and a buffet supper for those visiting the two companies.

Both L-R Heat Treating and Benedict-Miller have recently expanded their facilities and both are interesting examples of a modern commercial heat treating plant and the high quality workmanship and service rendered industry by Metal Treating Institute members.

PLUMP WOMEN are always cooking sweet things "for the children."

* * *

SOME OF US have been lucky but that doesn't mean that we depended on luck.

* * *

IF WE WORK HARD and others don't spend our money faster than we can make it, we may find ourselves better off in 1975 than we are right now.

* * *

FOR THOSE READERS who are easily shocked, the book that comes to their attention by mere chance is always loaded with sin, and always seems to open, again by mere chance, at the most sinful chapter.

* * *

A LITTLE GIRL explained to her mama who had attended Vassar that she was late from the movies because she had seen two Mickey Mouses. The mama said she should say two Mickey Mice. We are inclined to agree with the little girl's use of English. Mama's sounds pedantic.

New Heat Treating Furnace

A new car-type heat treating furnace is being installed by the Rust Furnace Company at the National Roll and Foundry Company, Avonmore, Pa., it was announced yesterday. A combination of fuel oil and natural gas will be used to fire the furnace. The unit will increase the company's heat-treating capacity for the production of rolls and commercial castings.

* * *

New Isopac C.G.X. Stop-Off Paste

An additional product has been brought on the market by the Denfis Chemical Laboratories Inc., Brooklyn, N. Y., manufacturers of the well known Isopac isolating paste.

This new product called Isopac C.G.X. is a stop-off paste sufficiently soft to be applied with a caulking gun or other pressure gun.

This compound is therefore especially suited to insulate large numbers of holes.

For example, it is now possible to fill very rapidly the centerholes of a stack of gears piled on top of each other.

Isopac C.G.X. is said to prevent the hardening of the protected areas while the rest of the workpiece is being hardened.

Since this product works on the principal of slowing down the cooling of the protected areas during the quench no hardness will be obtained even if used on high carbon steel (except self-hardening alloys).

"I DON'T CARE HOW SENSITIVE YOUR GRANDMA IS TO TEMPERATURE CHANGES,-WE STILL NEED SCIENTIFIC INSTRUMENT CONTROL!"

LETTERS TO THE EDITOR

Dear Editor:

A friend loaned me a copy of your Heat Treating magazine which helped me in a particular problem and greatly impressed me.

Please place my name on your mailing list. I know it will aid me immeasurably.

HARRY SIMMONS
Heat Treat Foreman, Sylvania Elec. Prod.

Dear Editor:

I have had the pleasure to receive several issues of "Metal Treating" and have found your magazine very interesting, containing educational articles of great value to the persons employed in our heat treating shop.

In order to have "Metal Treating" available regularly I would greatly appreciate to be put on your mailing list. If there is any charge please advise me.

If it is convenient for you to send me a copy of the July-August issue of 1951 or a preprint of the article "Distortion of Tool Steels in Heat Treatment", I should appreciate it very much.

HERMAN WINTERMARK
Metallurgical Engineer
A/S Carl Christensen og Brodre
Oslo, 45. Norge

Dear Editor:

Please add my name to your mailing list to receive Metal Treating. I find this to be a very interesting magazine.

FRANK F. PETZNICK
Works Manager
Ohio Forge & Machine Corp.
Cleveland 4, Ohio

Dear Editor:

In connection with your editorial entitled "The Heat Treating Industry Must Train Men for the Future", in the May-June issue of "Metal Treating", we would be pleased to receive a copy of the booklet on Standards of Apprenticeship for the Heat Treating trade.

We wish to take this opportunity to thank you for your courtesy in supplying us with your magazine and to express our appreciation for the many helpful suggestions it contains.

American Can Co. *J. H. WOLSEY*
Niagara Falls, Ont. *Plant Manager*

Dear Editor:

We find "Metal Treating" of considerable interest to us and would like to have our district offices receive this publication of the National Association of Commercial Heat Treaters.

Will you please put each of our district offices on your mailing list.

Hevi Duty Electric Co. *E. E. STAPLES*
Milwaukee 1, Wisc. *Vice President*

Dear Editor:

I had the pleasure of reading your July-August 1952 copy of "Metal Treating" and found it very helpful. This was the first time I had a chance to see your interesting publication.

If it is possible, please put me on your mailing list as I am sure that the information contained in your informative publication would be very helpful in my duties.

W. G. LEAMAN
Metallurgist
American District Steam Co., Inc.
North Tonawanda, N. Y.

Dear Editor:

I would greatly appreciate being put on your mailing list for your fine magazine "Metal Treating." We already receive one copy here in the plant which is circulated to interested people. However, I find several articles in it which I would like to cut out and retain.

The L. S. Starrett Co. *R. H. GRACE*
Athol, Mass. *Metallurgist*

Dear Editor:

I have received the copies of the Standards of Apprenticeship for Heat Treaters which you sent us on July 18. We would like to keep both the Union and the non-Union forms which you enclosed. We feel both would be of value to us in the future.

The new Standards seem to be very complete and we would like to thank you at this time for the copies you have sent.

Cutler-Hammer, Inc. *R. L. GREIVELL*
Milwaukee, Wisc. *Mfg. Engineer*

Editorial (cont.)

A man cannot duck the responsibilities of living without ceasing to be alive.

The willingness of citizens to be guided, directed, and protected in all things by a central governmental authority, no matter how benevolent, results only and always in the rise of that authority to absolute power and the reduction of that citizen to serfdom. Observe the record in many foreign lands.

Because of two World Wars, a present "Police Action" (117,000 casualties) and the delusion of many who took a share in that Utopian gold-brick, we are dangerously approaching the kind of all-powerful centralized government which laid low so many other nations.

The "withering blight of bureaucracy" has scorched us all, and threatens to consume.

Mostly, we Americans love to mind our own business. We are interested in our own affairs. Our Constitutional form of government—a Republic with checks and balances where the majority rules by vote, but the rights of the minority are always protected—gave us the security we needed to attend to our jobs, farms, and businesses. We took only a passing interest in politics. In fact we rather prided ourselves on not "messing in politics".

But "politics" is what determines the form of government under which we must live and conduct our affairs. The signers of the Declaration were "messing in politics" up to their necks, and at the extreme risk thereof.

If we, the workmen, the technicians, the businessmen of today fail to take an interest in politics, and a very active one, we will certainly lose the priceless freedom which many brave men before us so dearly won.

We *must* "mess in politics" if we are to cure the mess that politics is in.

We, in the heat treating industry, are an outstanding example of the great fundamental principle which accounts for America's industrial greatness—free competitive enterprise.

We are a part of Small Business, which produces most of America's goods, most of its jobs, and most of its prosperity.

But look at the network of bureaucratic restrictions under which we are now enmeshed—

Can you give a deserving employee a raise?

Can you get material for your business?

Can you expand your plant?

Can you lay aside a decent reserve to tide you over tough times?

WITHOUT PERMISSION OF A BUREAUCRAT?

YOU KNOW THE ANSWER!

Is that freedom of enterprise or is it State Socialism—by whatever name? Is that the America of Washington, Jefferson, Franklin, Lincoln?

If they had been faced with that situation, would they have "messed in politics"?

You *are* faced with it—What will *you* do? There is only one thing to do.

VOTE!

HORACE C. KNERR

CUT FURNACE TIME and FUEL BILLS with "PSC" LIGHT-WALL RADIANT TUBES

As a leading supplier of tubing to builders and users of radiant tube furnaces, Pressed Steel Company's assemblies dependably furnish such general features as compactness, removability, uniform heating over tube length, etc. The distinctive feature of PSC radiant furnace tubes is their light-wall construction. Installation records repeatedly show that this feature effects marked economies in fuel and furnace time. Our "light-wall" construction is based on a quarter century's experience in precision fabrication of sheet alloys.

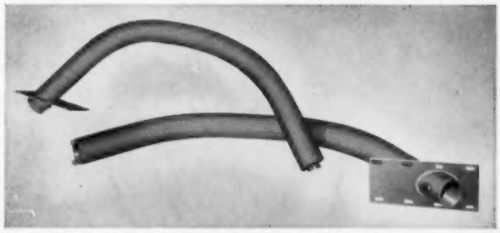
TUBE ASSEMBLIES FOR EVERY PURPOSE

Tubes for all types of radiant furnaces. We specialize in secondary burner tubes for highest temperatures. Let us show you how PSC light-wall tubes cut maintenance and furnace time.

PSC EQUIPMENT IS "ALLOY RIGHT"

Light-Weight **Heat-Treating Equipment for Every Purpose**

Carburizing and Annealing Boxes
Baskets · Trays · Fixtures
Muffles · Retorts · Racks
Annealing Covers and Tubes
Pickling Equipment
Tumbling Barrels · Tanks
Cyanide and Lead Pots
Thermocouple Protection Tubes
Radiant Furnace Tubes and Parts
Heat, Corrosion Resistant Tubing



We precision assemble the most complicated designs of radiant furnace tubes. Send blue prints or write us to your needs. We fabricate heat-treat units from the complete list of alloys. You can choose the metal that is "alloy-right" for your needs.

THE PRESSED STEEL COMPANY

of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

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